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In re Application of

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METHOD OF DIGITAL EXPOSURE
MODIFICATION OF IMAGES

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Sir:

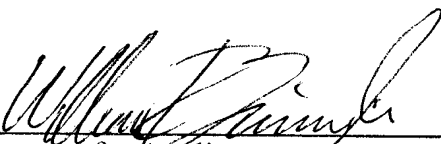
**REQUEST FOR CORRECTION TO PATENT
APPLICATION PUBLICATION**

Mistakes have been discovered in the above-captioned Publication. The Amendments to the Specification requested in the Preliminary Amendment mailed January 24, 2006 do not appear in the publication (see enclosed pages 1 and 4 of the Publication). The changes are indicated on page 2 of the Preliminary Amendment (copy enclosed).

Therefore, we are requesting a correction to the patent application Publication due to a United States Patent and Trademark Office error.

The Commissioner is hereby authorized to charge any fees in connection with this communication to Eastman Kodak Company Deposit Account No. 05-0225. **A duplicate copy of this letter is enclosed.**

Respectfully submitted,



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Enclosures

If the Examiner is unable to reach the Applicant(s) Attorney at the telephone number provided, the Examiner is requested to communicate with Eastman Kodak Company Patent Operations at (585) 477-4656.

METHOD OF DIGITAL EXPOSURE MODIFICATION OF IMAGES

FIELD OF THE INVENTION

[0001] The present invention relates to a method of digital exposure modification of shot images. Exposure modification means a correction or compensation of the image exposure. This can affect the image either all together or in some of its colors only. Exposure modification is an a posteriori modification, i.e. a modification made after the shooting. It consists in simulating the density of the image or the density of at least one of the colored components as they would have been obtained with a different exposure. The invention also relates to an image shooting method including a digital exposure modification step.

[0002] A posteriori exposure modification can result from technical choices or artistic choices.

[0003] From an artistic viewpoint, a first cameraman or a photographer can decide to over-expose or under-expose a film in order to increase or on the contrary to reduce the apparent grain of the images. They can also decide to use shifts of color or color temperature to give images a special "atmosphere". Color and exposure shifts, for instance, enable nighttime recording conditions to be simulated for scenes shot in the daytime.

[0004] A posteriori exposure modification can also be for simply technical reasons. Indeed, the possibility of correcting exposure a posteriori enables the almost indifferent use of Day Light or Tungsten type films when shooting.

[0005] The invention can have applications in various fields of shooting on film, and in particular in motion picture and cinema fields.

BACKGROUND OF THE INVENTION

[0006] A silver film, such as a cinema film, for instance, is essentially characterized by its sensitometry curve. The sensitometry curve demonstrates the film's response to the exposure light impacting it. More precisely it links the light energies received by the film to the density values resulting from chemical processing of the film.

[0007] The sensitometry curve that may be established for each of the film's primary colors, is valuable data for adjusting cameras, but also for adjusting the processing parameters that occur after the shooting, such as, for instance, development. These parameter adjustments are generally performed with reference to standard sensitometry curves.

[0008] Indeed, film manufacturers generally provide users with the standard sensitometry curves for each film type. These standard curves reflect the film's behavior as it is for marketing purposes, and subject to reference chemical processing.

[0009] However, the film's response to light is not stable over time. It is liable to be modified especially with the aging of the film and the thermal stresses suffered by the film. The chemical processing the film has been subject to, such as development, also affects its density in response to a received light exposure.

[0010] A film sensitometry curve can be reconstituted by taking care first to form a sensitometry control on part of the

film. The control has several ranges that have received different exposure energies. These are known exposure energies or at least exposure energies whose value or graduation can be established by calculation. The sensitometry control is preferably formed when shooting. Indeed, the part of the film bearing the sensitometry control undergoes the same stresses, the same aging and the same chemical processing as the rest of the film. Thus it enables changes of its characteristics to be taken into account faithfully.

[0011] There is another difficulty when a film is digitized. This is linked to the scanner's more or less good reliability, to its more or less accurate calibration, and to the digital processing chain. It can also be useful to take a sensitometry control into account. For illustration, ~~document (1)~~ can be referred to whose exact reference is given at the end of the present description.

[0012] ~~Document (1)~~ relates to the capture of digital values and their processing in order to correspond as accurately as possible to the filmed scene.

SUMMARY OF THE INVENTION

[0013] The invention does not target the capture of digital values but their modification in order to simulate special shooting conditions, which amounts to the a posteriori modification of the exposure conditions. The processing used on the digital values, still called digital codes, consists in replacing these codes by codes corresponding to a greater or lesser exposure. It can be performed on all the color components or on only part of the color components, and enable the image rendering to be changed to a large extent. However, it is observed that the modification of digital codes often affects the images' natural character.

[0014] It is the object of the invention to propose a method of digital modification of image exposure that does not have the above-mentioned difficulties.

[0015] In particular one object is to enable exposure modification for one or more color components that does not affect the images' natural character.

[0016] Yet another object is to facilitate the digital processing of images by reducing the control parameters made available to the user.

[0017] To achieve these objects, the invention more precisely relates to a method of digital exposure modification of the shot images of a photographic support comprising the shot images and at least one sensitometry control corresponding to many exposure values, the method comprising the following steps:

[0018] a) the digitization, substantially the same conditions, of the images and the sensitometry control, in order to link at least one digital code to the image and sensitometry control pixels.

[0019] b) the establishment of at least one sensitometry relationship from the various exposure values of the sensitometry control and the digital codes linked to the pixels corresponding to these values.

[0020] c) the shift of at least one part of the digital codes of the image pixels, each code being shifted by a value established according to required a modification ampli-

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No. 6,439,784

us Patent No. 6,439,784

are not performed with a continuous curve but with a table of discrete values, such as the table of FIG. 2, and the new exposure value or digital code is not given in the table, the closest existing digital exposure value or code can be used.

[0057] A conversion table is shown summarily in FIG. 4 with reference 23. Such a table can then be used as lookup table (LUT) to establish the new digital codes of all the images of the same film. The input values X_i are the image digital codes and the output values X'_i are the modified values.

[0058] Conversion tables can be drawn up for various exposure modifications and for various color components.

[0059] The establishment of conversion tables and their use to correct the exposure can be operations performed by software. They can also be cabled. With reference to FIG. 4, it can be seen that the table does not have to include values for all the possible codes but only for codes located in a value range corresponding to the film's maximum contrast and/or to the scanner's adjustment range.

[0060] New digital codes are recorded in new image files 36, as shown in FIG. 1. According to another possibility, the new image files 36 can be the same as the former files 26, i.e. containing the same digital codes, but by including, as metadata, the modifications to be made to the codes. For instance, the new files can contain the data of the conversion table of FIG. 4.

[0061] The files 26, containing the not-yet-modified codes, can also contain metadata. These can include, for instance, data on the exposure modifications or the exposure compensations required by a first cameraman.

~~REFERENCE DOCUMENT~~

[0062] ~~(1) U.S. Pat. No. 6,439,784~~

1. A method of digital modification of the exposure of the shot images of a photographic support comprising shot images and at least one sensitometry control, the method comprising the following steps:

- a) the digitization, in substantially the same conditions, of the images and the sensitometry control, in order to link at least one digital code to the image pixels and the sensitometry control pixels,
- b) the establishment of at least one sensitometry relationship from the various exposure values of the sensitometry control and the digital codes linked to the pixels corresponding to these values,
- c) the shift of at least one part of the digital codes of the image pixels, each code being shifted by a value

established according to a required modification amplitude of the exposure and, with respect for the sensitometry relationship.

2. A method according to claim 1, wherein the shift value of each code depends on said code.

3. A method according to claim 2, wherein the step c) comprises, for each code:

the search for an exposure value linked to the digital code by the sensitometry relationship,

the shift of this exposure value by the required exposure modification amplitude, to obtain a modified exposure value,

the search for a new digital code linked to the exposure value modified by the sensitometry relationship,

the replacement of the digital code by the new digital code.

4. A method according to claim 1, wherein the step b) comprises the formation of a value table linking a digital code to each exposure energy of the sensitometry control.

5. A method according to claim 4, wherein the formation of the value table comprises the establishment of intermediate exposure energy values by interpolation, and the linking of an exposure energy value to each digital code of a set range of codes.

6. A method according to claim 1, wherein the sensitometry control is recorded on the support more or less concomitantly with the images.

7. A method according to claim 1, wherein the step c) comprises the forming of a conversion table for each required exposure modification, the conversion table linking a code shifted with respect to the sensitometry relationship to each digital code in a set code range, and, the conversion of image digital codes by using the conversion table as a lookup table.

8. A method according to claim 7, wherein a separate conversion table is established for each color layer of the photographic support.

9. A method according to claim 7, wherein the same conversion table is used for all the images found on the same photographic support.

10. A shooting method comprising the capture of images on a photographic support and the forming of at least one sensitometry control on the same photographic support, and following development of the support, digital modification of the exposure, according to the method of claim 1.

* * * * *

Amendments to the Specification:

Please replace the paragraph appearing on page 2, line 20, of the specification with the following rewritten paragraph:

--There is another difficulty when a film is digitized. This is linked to the scanner's more or less good reliability, to its more or less accurate calibration, and to the digital processing chain. It can also be useful to take a sensitometry control into account. For illustration, ~~document (1)~~ U. S. Patent No. 6,439,784 can be referred to whose exact reference is given at the end of the present description.--

Please replace the paragraph appearing on page 2, line 25, of the specification with the following rewritten paragraph:

--~~Document (1)~~ U.S. Patent no. 6,439,784 relates to the capture of digital values and their processing in order to correspond as accurately as possible to the filmed scene.--

Please delete the text appearing on page 10, lines 13 and 14, of the specification.